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1 571 080

PATENT SPECIFICATION

(11) 1 571 080

(21) Application No. 45597/75 (22) Filed 1 Nov. 1975
(21) Application No. 273/76 (22) Filed 6 Jan. 1976
(23) Complete Specification filed 29 Oct. 1976
(44) Complete Specification published 9 July 1980
(51) INT CL³ E04C 1/10; F27D 1/00
(52) Index at acceptance
E1B 1A1A 1A1X 1C3B 1C3D 1C5A 1C5B 1C5X 1G1
F4B 35A1 35A3X 35F3 35FX 35H

(19)

(54) MODULAR WALL STRUCTURES

(71) I, RONALD THOMAS BULLOCK, a British Subject of 82, Lesley Drive, Kingswinford, Brierley Hill, West Midlands, do hereby declare this invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to improvements in modular wall structures adapted to be build up from a number of co-operating units.

Many proposals for modular panel units have been made before. For example it is known to construct tanks from pressed rectangular sheet metal panels bolted together by flanges at their edges. It has also been proposed to build structures of interengaging panels of precast concrete or of refractory materials. However, where the structure has been of substantial height, such that the panels themselves are not of sufficient strength and rigidity to be self-supporting, it has hitherto been necessary to provide a separate external or internal supporting structure of columns and beams, to which the panels are secured. This adds to the expense and complication and defeats the object of using modular units, namely, speed of erection and if necessary, of removal.

The aim of the present invention is to provide a modular wall structure which can be built up to substantial heights without the above-mentioned drawbacks.

According to my invention a unit for the construction of a wall comprises a rectangular frame from which cladding is supported on at least one of its major faces and comprising top and bottom members and two side members and having rigidly and permanently secured thereto at least two laterally spaced rigid structural vertical metal support members (in addition to or forming part of the frame itself) in the form of tubes extending between the levels of the top and bottom members, the tubes having spigots extending outwards at one end of each for engagement in a corresponding tube of an adjacent identical unit when the units are assembled one above the other so that the mutually engaging tubes form continuous rigid load-taking columns.

A wall of any defined dimensions or an enclosure formed by surrounding walls can thus be erected rapidly and easily with a minimum of labour and can be dismantled equally easily when no longer required.

The tubes are preferably contained within the thickness of the frame.

Preferably the units are of such dimensions and weight that they can be handled manually without the need for lifting gear.

The frame may be clad on one or both sides with panels in the form of steel sheets, and if the wall is to be heat-resisting, as for example if it forms the wall of a furnace or of an enclosure within which heat treatment or like processes are to be carried out, the cladding will be of heat-resisting steel and refactory material may be carried by one of the panels or housed within the frame. Where high temperature resistance is not required the unit may simply contain thermally insulating material within the frame.

Some embodiments of my invention are illustrated by way of example in the accompanying drawings in which:—

Figure 1 is a front elevation of one form of unit incorporating internal structural members but before application of the front wall,

Figure 2 is a horizontal section on the line 2—2 of Figure 1, but with the front wall and refractory covering in place,

Figure 3 is an end view of the unit, locking from the left in Figure 2,

Figure 4 is a perspective view of the unit from the front,

Figure 5 is a rear perspective view of the unit,

Figure 6 is a perspective view showing the erection of a wall from units as shown in Figures 1 to 5,

Figure 7 is a perspective view of an enclosure built up from the units,

Figure 8 is a perspective view of a modified form of unit, and

Figure 9 is a perspective view of a further modified form of unit.

The unit shown in Figures 1 to 5 comprises a rectangular frame 1 fabricated from inwards-facing channel-section mild steel sheet of which the flanges are mitred at the corners. The top, bottom and two side members may be made separately and welded together or may be formed at least partly in pairs or all together by notching and folding a single length of channel.

The steel tubes 2 designed to form support members extend vertically through the frame adjacent to each side member and against one inside face, the ends of the tubes being welded around openings in the top and bottom members of the frame. Short lengths of tube 3 of such a diameter as to be a sliding fit in the tubes 2 are welded into the upper ends of the tubes 2 and project from the upper end of the frame to form spigots adapted to engage in the lower ends of the tubes 2 in a superimposed unit.

The unit is designed for use where resistance to heat is required and one face of the frame is closed by a panel 4 of heat resisting steel. On the outer face of that there is a layer 5 of refractory material such as rockwool of substantial thickness with a facing 6 of high density ceramic fibrous material, both being enclosed in a casing 6a of thin stainless steel sheet or foil folded around the refractory material in the form of a shallow tray.

The other face of the frame may be clad with a steel sheet (not shown) and that can be of ordinary mild steel.

Units as described above are adapted to be assembled to form a heat-resisting wall in the manner shown in Figure 6. The operator simply has to lift each upper unit into vertical alignment with a lower unit and drop it into position. The tubular spigots 3 projecting from the lower unit enter the lower ends of the tubes 2 in the upper unit to couple the units together and no other structural members are required. The sections of tube in the individual units join together to make continuous vertical load-taking columns.

The meeting vertical edges of corresponding frames in adjacent vertical assemblies are secured together by bolts passing through holes 8 in the side members of the frames.

Where the wall is a permanent structure or is to be in use for a prolonged period the meeting horizontal edges of superimposed frames may also be secured together by bolts.

The meeting edges of the units can be sealed with any convenient refractory sealing material as indicated at 7 in Figure 3. Figure 2 shows the refractory material 5 and 6, enclosed in the stainless steel casing 6a, of slightly smaller dimensions than the frame in width and height. When units are assmbled together to form a wall this leaves a small gap around the refractory. The gaps are filled with a wet ceramic fibre sealing material which is compressed where adjacent units are bolted together with the frames 1 in direct metal-to-metal contact.

In Figure 7 is shown an example of a heat treatment furnace being built up *in situ* from the units of Figures 1 to 5, in the manner shown in Figure 6, to enclose a very large body which is to be heat-treated and which is too big to move to any static furnace. After the heat treatment the furnace can be rapidly disassembled and the units can be used again elsewhere.

The construction of unit shown in Figures 1 to 5 in which the structural members are incorporated within the thickness of the frame is preferred as it is compact and a wall formed from these units is of a minimum thickness, but it will be appreciated that the structural members may be external to the frame.

Such an arrangement is shown in figure 8 where a frame 9 e.g. of the view shown in Fig. 1 is carried by a structure 10 built up from tubes of square cross-section welded together. Spigots 11 are welded into and project from the upper ends of the vertical members of the structure for engagement in the lower ends of the corresponding members of a superimposed unit.

The structure 10 may conveniently be welded to a panel 12 which is welded or otherwise secured to one face of the frame 9. Thus the structure 10 is rigidly and permanently secured to the frame through the medium of the panel 12. The other face may be clad, like that of Figures 1 to 5, with a dimpled cladding sheet of stainless steel 13 which may be in the form of a flanged tray of which the peripheral flanges are folded over a steel plate welded or otherwise secured to the frame, the tray enclosed heat-resisting material.

The units described above may be used to make furnaces or heat-treatment enclosures. Where the units are to be employed to make fire walls in buildings the refractory material may be incorporated within the thickness of the frame. Where thermal insulation is required but without the need for resistance to high temperatures an ordinary non-refractory thermal insulating material may be used, for example where walls are to be built for a cold store or warehouse, and in that case the insulating material is again preferably within the thickness of the frame and the frame is clad on both faces with any suitable thin sheet material such as mild steel sheet or asbestos sheet or even wood or plastics material.

In a further modification the frame 1 could be of tube rather than channel or even of wood.

The further version shown in figure 9 is suitable for the construction of walls of buildings. Instead of two vertical tubes there are four, shown at 14. They are joined by transverse horizontal tubes 15 of slightly smaller gauge, and by longitudinally extend-

ing horizontal tubes 16 to form rectangular frames. In this example the spigots, shown at 17 are formed by swaging down the ends of the main tubes 14 instead of welding in separate lengths of tube. Both the front and back faces of the tubular frame structure are closed by sheet metal panels 18 in the form of flanged pressings.

The version shown in Figure 9 is particularly suitable for the rapid construction of permanent walls as the space between the front and back panels can, in the finished wall, be filled with poured-in concrete. The horizontal distance between the axes of the two tubes that are adjacent to a given major face is preferably equal to half the overall width of the unit so that successive rows of units can be staggered horizontally by a distance equal to half the width of a unit and the structure is thus bonded like courses of brickwork. Half-width panels may be provided to finish off the ends of a wall.

WHAT I CLAIM IS:—

1. A unit for the construction of a wall comprising a rectangular frame from which cladding is supported on at least one of its major faces and comprising top and bottom members and two side members and having rigidly and permanently secured thereto at least two laterally spaced rigid structural vertical metal support members (in addition to or forming part of the frame itself) in the form of tubes extending between the levels of the top and bottom members, the tubes having spigots extending outwards at one end of each for engagement in a corresponding tube of an adjacent identical unit when the units are assembled one above the other so that the mutually engaging tubes form continuous rigid load-taking columns.

2. A unit as claimed in claim 1 in which the support members are separate from the members of the frame itself.

3. A unit as claimed in claim 1 in which each tube extends from the top member of the frame to the bottom member and is welded around an opening in each of those members, the spigot extending beyond one of those two members.

4. A unit as claimed in claim 3 in which the tubes are two in number and lie inside and immediately adjacent to the side members of the frame.

5. A unit as claimed in claim 4 in which the tubes lie immediately adjacent one of the major faces of the frame.

6. A unit as claimed in claim 4 in which the tubes are spaced apart laterally by a distance equal to half the width of the unit.

7. A unit as claimed in any of claims 1 to 6 in which one face of the frame has applied to it a steel panel of which the outer face carries a layer of heat-resistant material.

8. A unit as claimed in claim 7 in which the heat-resistant material comprises refractory fibres enclosed in a stainless steel casing.

9. A unit as claimed in claim 1 or claim 2 which incorporates heat resisting or thermally insulating material inside the frame.

10. A wall formed by an assembly of units as claimed in any one of claims 7, 8 or 9 in which the joints between adjacent units are sealed with heat resisting material.

11. A unit for the construction of a wall substantially as described with reference to Figures 1 to 5 of the accompanying drawings.

12. A unit for the construction of a wall substantially as described with reference to Figure 8 of the accompanying drawings.

13. A unit for the construction of a wall substantially as described with reference to Figure 9 of the accompanying drawings.

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Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1980.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

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Sheet 1

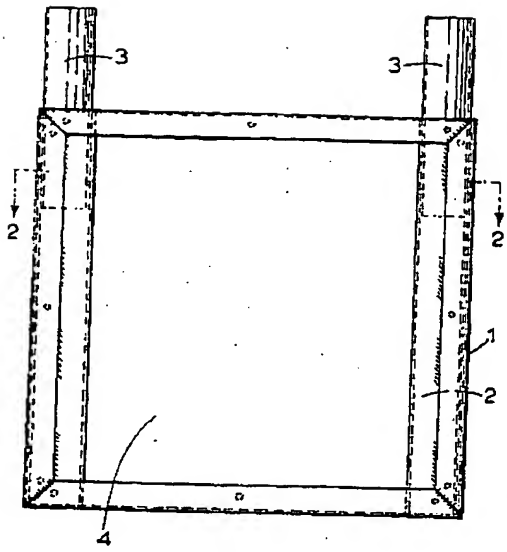

FIG.1.

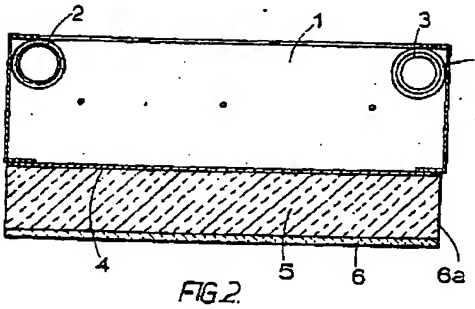

FIG.2.

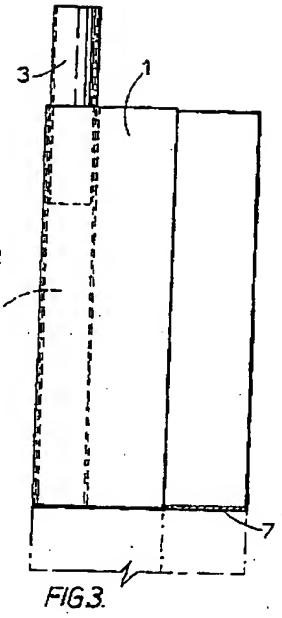

FIG.3.

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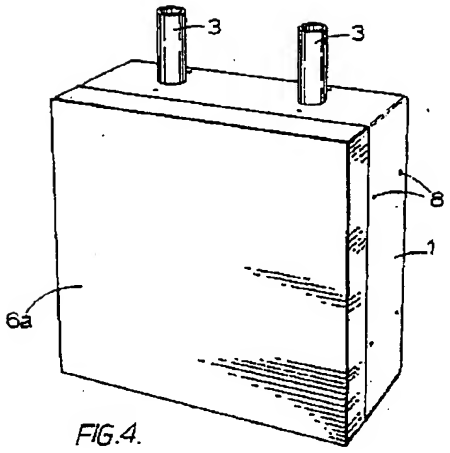

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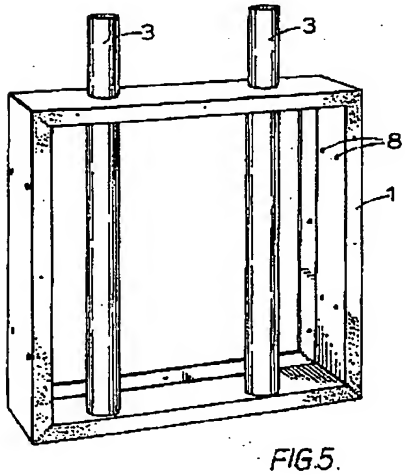

FIG.5.

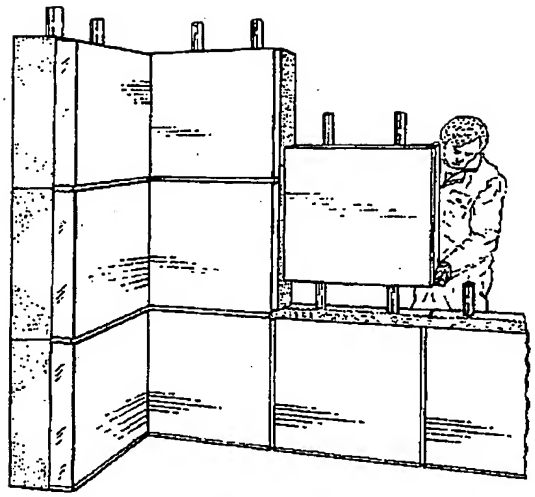

FIG.6.

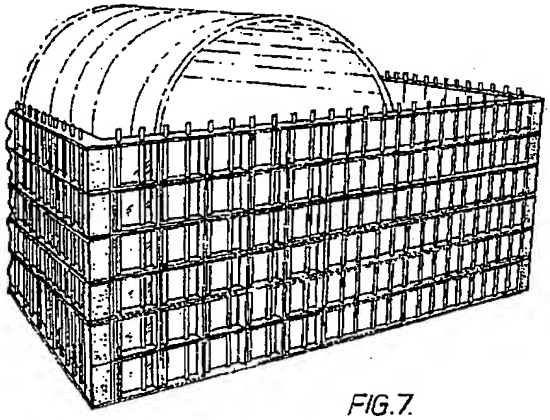

FIG.7.

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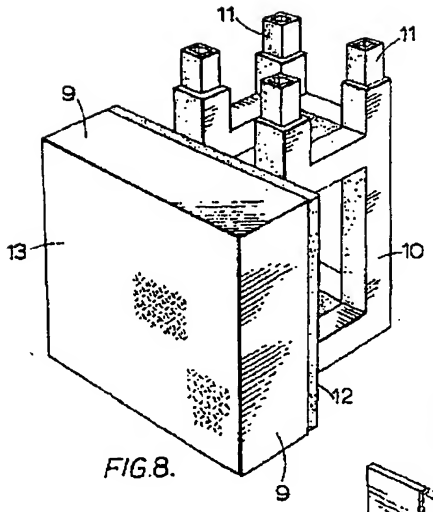

FIG.8.

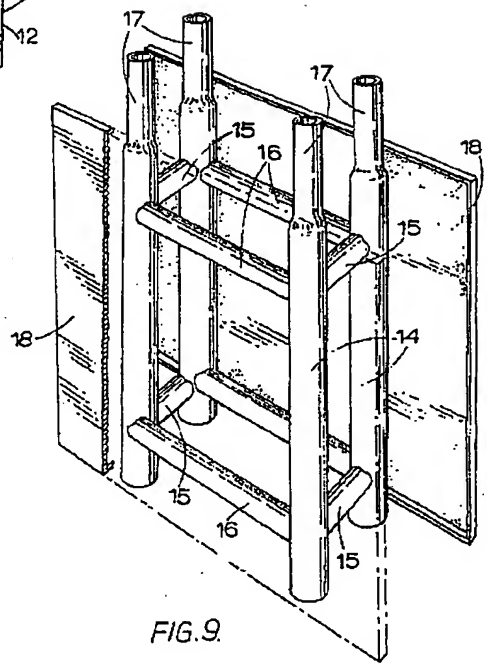

FIG.9.